

but all later authors that I have checked (Hartert 1910; Vaurie 1959; Ripley 1961; Dement'ev *et al.* 1968), perhaps following Seebohm's (1881) *Catalogue of the Birds in the British Museum*, have overlooked Blyth's emendation and used Jerdon's original but incorrect spelling.

The etymology of the name is from the Greek *phragmatos* = "hedge" and the Latin *cola* = "dweller". Thus the proper form of Jerdon's generic name should be *Phragmaticola*.

Dr. Sálím Ali first raised the question to me about the proper spelling of the name. Drs. George E. Watson and S. Dillon Ripley kindly read and commented on the manuscript.

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## The taxonomic status of Milne-Edward's fossil Sulids

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### SUMMARY

Three species assigned by Milne-Edwards to the genus *Sula* are re-examined using the narrower generic criteria now current. *Sula ronsoni* of the Lower Oligocene appears to be a cormorant and is assigned to *Prophalacrocorax* (*gen. nov.*). *Sula arvernensis* of the Upper Oligocene appears to be a true sulid but generically distinct from other forms, and is assigned to *Parasula* (*gen. nov.*). *Sula pygmaea*, assigned by Brodkorb to *Microsula*, is based on the humerus of a Middle Miocene bird that co-existed with peleciform birds showing typically divergent osteological characters. The specimen shows very generalised characters and cannot certainly be assigned to any peleciform family. It is here assigned to *Pseudosula* in the Pseudosulidae (*gen. et fam. nov.*).

When Alphonse Milne-Edwards published his work on French bird fossils about a century ago he named a large number of new species. Using

the criteria of the times he recognised very broad genera and a much simpler taxonomic structure than would be recognised now. As a result he assigned many of his new forms to Recent genera although the specimens on which they were based showed distinct osteological peculiarities. Subsequently his species have been integrated in taxonomic lists with later ones based on much more critical appraisals of morphological characters. During a survey of known fossil sulids it has become apparent that Milne-Edwards's species in this group require a re-appraisal in the contest of modern taxonomy.

The earliest of the species which he assigned to the Sulidae is *Sula ronsoni* Milne-Edwards, 1867. The specimen is an incomplete pelvis from the marnes calcaires de Ronzon, Lower Oligocene; Ronzon, near Puy-en-Velay, Auvergne. It was presumably placed in *Sula* because it shows narrow anterior iliac shields similar to those present on the specimen of *Morus bassanus* used by Milne-Edwards as his typical sulid. The pelvis is narrower and less laterally-projecting at the pectineal processes than are those of the Sulidae, and more closely resembles that of *Phalacrocorax*.

The pubes are stouter than those of *Phalacrocorax* and more like those of *Sula*, but the very long posterior synsacral region and narrowness of the pelvis match those of the former and are diagnostic characters. The constriction of the posterior ilium referred to by Milne-Edwards in his description is a variable character of the Phalacrocoracidae, and not critical in the present species. It seems necessary, on the characters available, to refer the specimen to the cormorants, Phalacrocoracidae, but to create a new genus for it. I therefore propose:—

*Prophalacrocorax gen. nov.*

*Etymology.* The generic name consists of the Greek prefix *pro* (=before) combined with the generic name of the typical cormorants, *Phalacrocorax*.

*Type species.* *Prophalacrocorax ronsoni* (Milne-Edwards) 1867.

*Diagnosis.* Posterior synsacrum and pelvis elongated. Pelvis generally narrow and iliac region posterior to acetabulum of even width. Pubes stout. Pectineal area slightly prominent laterally. Anterior lateral edges of iliac shields not very prominent or strongly curved; and posterior area of shield, anterior to acetabulum, not markedly constricted.

*Comparison.* Size similar to that of *Phalacrocorax carbo*.

The next species is *Sula arvernensis* Milne-Edwards, 1867. The specimen consists of a matrix block with an incomplete pelvis exposed dorsally and a sternum exposed ventrally, from the calcaire de Gannat, Upper Oligocene; Gannat, Allier. The pelvis shows general proportions like those of a sulid species, with the shorter synsacrum. The anterior end of the sternum is similar to that of *Sula* species. The posterior portion shows a number of peculiarities. The costal margin is proportionally shorter, the posterior half of the sternum a little broader with a curved lateral margin, the posterior lateral processes long, narrow and incurved, the sternal notch deep, and the middle area between the notches broad, as long as the lateral processes and divided into three lobes.

This posterior part of the sternum shows some superficial similarities to the sterna of Gaviiformes and Podicipitiformes. In view of its peculiarities the specimen cannot be assigned to an already known Recent or extinct sulid genus and, although it may be ancestral to other sulids, it requires a new generic name. I therefore propose:—

*Parasula gen. nov.*

*Etymology.* The generic name is formed from the Greek prefix *para* (= "by the side of", hence "like") and the name of the Recent genus *Sula* which it resembles in some respects.

*Type species.* *Parasula arvernensis* (Milne-Edwards) 1867.

*Diagnosis.* Sternum with narrow and anteriorly-projecting manubrial region. Coracoid sulcus sloping diagonally towards posterior, bluntly angled at labial prominence. Costal margin short. Sternum long with broad posterior end. Posterior lateral processes narrow, long and incurved; sternal notch long and narrow. Median, xiphial area of sternum broad, with three processes projecting to level of lateral processes. Pelvis with divergent posterior ridges of anterior iliac crest well-defined, and pelvic shield between acetabula slightly concave. Posterior and laterally-tapering shields of ischium projecting posteriorly well beyond synsacrum.

*Comparison.* Pelvis anterior to acetabula is of similar length to that of *Morus bassanus* but with the lateral edges of the anterior iliac shields a little less prominent. Posterior to the acetabula the pelvis is of similar width to that of *Sula variegata*, but about one-third as long again.

The final species to be considered is *Sula pygmaea* Milne-Edwards, 1874. The specimen is a small left humerus of a sea-bird, from the molasse de Léognan, Middle Miocene; Léognan, Gironde. Milne-Edwards recognised its similarity to the humeri of Pelecaniformes and assigned it to *Sula*. Wetmore (1938) described a typical small sulid from the Upper Miocene of North America, assigning it to a subgenus, *Microsula*, of the genus *Sula*. Brodkorb (1963), in compiling his catalogue, emended the period of the latter to Middle Miocene, elevated *Microsula* to a genus, and also assigned *pygmaea* to it.

Wetmore's material indicates that typical sulids were present in the Middle Miocene. *M. pygmaea* is not only atypical of both *Microsula* and *Sula*, but also so different in its characters that it does not seem reasonable to retain it in the Sulidae, since the characters available could also be used to link it closely to other families such as the Fregatidae or Phaethontidae. In the circumstances it cannot be linked with extant pelecaniform families and therefore requires a new taxon. I propose:—

PSEUDOSULIDAE *fam. nov.*

*Diagnosis.* Humerus small and slender. Proximal end proportionally small and palmar/anconally flattened with only slight anconal curvature. Head proximally prominent and rounded. External tuberosity poorly-developed. Internal tuberosity short and externally curved. Bicipital surface large, with well-defined distal edge, but not palmarly prominent. Ligamental furrow deepest at internal edge. Distal end with olecranal fossa proximally deep but palmarly shallow; internal edge broad and flattened. Ectepicondyle with paired muscle pits. External condyle stout. Brachialis anticus impression proximally sited, proximo-externally elongated and forming a double impression.

*Pseudosula gen. nov.*

*Etymology.* The generic name is formed from the Greek prefix *pseudo* (= false), and *Sula*, the typical sulid genus in which it was previously placed.

*Type species.* *Pseudosula pygmaea*. (Milne-Edwards) 1874.

*Diagnosis.* Characters those of family.

*Comparison and discussion.* In size the specimen resembles the humerus of *Phalacrocorax aristotelis*. The length is c. 128, width of proximal end at tuberosities 17, and width of distal end 15 mm. The prominent and centrally-placed head, sloping distally to the tuberosities, is more similar to those of *Pelecanus*, *Phaethon* or *Fregata*, although in some earlier sulids such as *Palaeosula stocktoni* (Howard 1958) the proximal head is more prominent than in Recent species. The distally shorter and rather broad bicipital surface, reducing the width of the ligamental furrow at the proximal edge, is more like that of *Phaethon* and *Fregata*, but the proximal view of the proximal end would more closely resemble that of *Sula* or *Morus* if the internal end of the head were less inflated in these. The deltoid crest is more developed than those of the Sulidae, although the curved line of muscle attachment on the distal palmar end and the shallow adjacent groove on the shaft are fairly similar to those of *Sula sula*.

The elongated and slightly angled shaft and the small proximal end resemble in these respects those of sulids, but the distal end is narrower except at its extremity, the brachialis anticus scar is narrower and more proximally elongated, the external condyle is longer and stouter, and the hollow between external condyle and the ridge of attachment of the anterior articular ligament is narrower and deeper than on the Sulidae.

The distally prominent entepicondyle typical of most of the Recent Pelecaniformes is absent. The ridge of attachment of the anterior articular ligament is less externally placed than on many Pelecaniformes, the internal side lacking the marked palmar inward slant and the ridge being stout and more similar to those of the Phalacrocoracidae. The olecranal fossa is fairly deep proximally but has only shallow penetration into the head anconally, differing in this respect from typical Pelecaniformes.

On the anconal side towards the proximal head the central ridge of the shaft divides, curving outwards towards the two tuberosities. The bicipital crest has a small distal flange on the internal edge bordering the pneumatic fossa. There is only a narrow rim between the fossa and the internal end of the ligamental furrow.

From the sum of the above characters there is an indication of slight similarity to a more simplified sulid structure, but the problem of assigning the specimen lies in its very generalised nature. If it had occurred long before the known sulids, it might have been acceptable to tentatively place it as an ancestral sulid, though not in an extant genus. However, material assignable to Recent sulid genera occurs in both Lower and Middle Miocene. In addition the various small pelecaniform families are characterised by marked morphological specialisation. The Sulidae are less specialised in the structure of some of their bones, to an extent where any pelecaniform species with less specialised structure is likely to bear more resemblance to them than to other families within the order. It is therefore unwise to assume that such similarities as exist indicate close affinity, and preferable to avoid such inferences by assigning *pygmaea* to a separate taxon.

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